

WHAT IS CLAIMED IS:

1. A transducer diaphragm, comprising:
an IC-compatible support structure; and
a polymeric membrane layer formed on the support structure.
2. The transducer diaphragm of claim 1, wherein:
the polymeric membrane layer includes one of Mylar, FEP, a PTFE fluoropolymer, Teflon® AF, polyimide, a silicone, or Parylene.
3. The transducer diaphragm of claim 2, wherein:
the polymeric membrane layer has a thickness in the range from about 0.1 μm to about 10 μm .
4. The transducer diaphragm of claim 1, wherein:
the polymeric membrane layer is spun or deposited onto the support structure using micromachining techniques.
5. The transducer diaphragm of claim 1, wherein:
the support structure is formed from an electrically insulating or semiconducting glass, ceramic, crystalline, or polycrystalline material.
6. The transducer diaphragm of claim 1, wherein:
the polymeric membrane layer adheres to the support structure without requiring gluing.
7. The transducer diaphragm of claim 1, further comprising:
an electret layer formed on the polymeric membrane layer by micro-machining techniques.

8. The transducer diaphragm of claim 7, wherein:
the electret layer is thermally annealed to stabilize charge therein.
9. The transducer diaphragm of claim 7, wherein:
the electret layer is heated to about 100°C for about 3 hours for thermal annealing.
10. The transducer diaphragm of claim 7, wherein:
the electret layer comprises a charged dielectric film formed on the polymeric membrane layer.
11. The transducer diaphragm of claim 10, wherein:
the dielectric film is charged by implanting electrons into the dielectric film by means of a thyatron.
12. The transducer diaphragm of claim 10, wherein:
the dielectric film is formed from one of Mylar, FEP, a PTFE fluoropolymer, Teflon® AF, a silicone, or Parylene.
13. The transducer diaphragm of claim 7, wherein:
the electret has a saturated charged density from about 2×10^{-5} C/m² to about 8×10^{-4} C/m².
- ~~14.~~ A transducer back plate, comprising:
a support structure defining a back volume; and
a membrane layer formed on the support structure, the membrane layer having a front face and a rear face, the membrane layer comprising a plurality of cavities extending from the front face to the rear face, thereby providing for communication between the front face and the back volume.

15. The transducer back plate of claim 14, further comprising:

a polymeric reinforcing film formed on the membrane layer, the plurality of cavities extending through the polymeric reinforcing film.

16. The transducer back plate of claim 15, wherein:

the polymeric reinforcing film includes one of Mylar, FEP, a PTFE fluoropolymer, Teflon® AF, a silicone, or Parylene.

17. The transducer back plate of claim 16, wherein:

the polymeric reinforcing film has a thickness in the range from about 0.1 μm to about 10 μm .

18. The transducer back plate of claim 15, wherein:

the polymeric reinforcing film is spun or deposited onto the membrane layer using micromachining techniques.

19. The transducer back plate of claim 14, wherein:

the support structure is formed from an electrically insulating or semiconducting glass, ceramic, crystalline, or polycrystalline material.

20. The transducer back plate of claim 15, further comprising:

a spacer formed on the polymeric reinforcing film to define an air gap, the air gap communicating with the back volume through the plurality of cavities.

21. The transducer back plate of claim 14, wherein:

the plurality of cavities comprises an array of about 25,000 holes extending through the membrane layer.

22. The transducer back plate of claim 21, wherein:
the membrane layer has a diameter of about 8 millimeters.

23. The transducer back plate of claim 14, further comprising:

an electret layer formed on the membrane layer by micro-machining techniques.

24. An electret sound transducer, comprising:

a transducer diaphragm including an IC-compatible membrane (support structure) and a (polymeric membrane) layer formed on the membrane support structure by micro-machining techniques, the transducer diaphragm having a (first electrode);

a transducer back plate having a (second electrode) and formed by micro-machining techniques; and

an (electret layer) formed on at least one of the transducer diaphragm or the transducer back plate, the transducer diaphragm being positioned adjacent to the transducer back plate to form an electret sound transducer.

25. The electret sound transducer of claim 24, wherein:

the polymeric membrane layer includes one of Mylar, FEP, a PTFE fluoropolymer, Teflon® AF, polyimide, a silicone, or Parylene.

26. The electret sound transducer of claim 25, wherein:

the polymeric membrane layer has a thickness in the range from about 0.1 μm to about 10 μm .

27. The electret sound transducer of claim 24, wherein:
the polymeric membrane layer is spun or deposited onto
the membrane support structure using micromachining
techniques.

28. The electret sound transducer of claim 24, wherein:
the membrane support structure is formed from an
electrically insulating or semiconducting glass, ceramic,
crystalline, or polycrystalline material.

29. The electret sound transducer of claim 24, wherein:
the polymeric membrane layer adheres to the membrane
support structure without requiring gluing.

30. The electret sound transducer of claim 24, wherein:
the transducer back plate comprises a back plate support
structure defining a back volume and a back plate membrane
layer formed on the back plate support structure, the back
plate membrane layer having a front face and a rear face, the
back plate membrane layer comprising a plurality of cavities
extending from the front face to the rear face, thereby
providing for communication between the front face and the
back volume.

31. The electret sound transducer of claim 30, further
comprising:

a polymeric reinforcing film formed on the back plate
membrane layer, the plurality of cavities extending through
the polymeric reinforcing film.

32. The electret sound transducer of claim 31, wherein:

the polymeric reinforcing film includes one of Mylar, FEP, a PTFE fluoropolymer, Teflon® AF, a silicone, or Parylene.

33. The electret sound transducer of claim 32, wherein:
the polymeric reinforcing film is about 2.5 μm thick.

34. The electret sound transducer of claim 31, wherein:
the polymeric reinforcing film is spun or deposited onto the back plate membrane layer using micromachining techniques.

35. The electret sound transducer of claim 30, wherein:
the back plate support structure is formed from an electrically insulating or semiconducting glass, ceramic, crystalline, or polycrystalline material.

36. The electret sound transducer of claim 31, further comprising:
at least one spacer positioned between the transducer diaphragm and the transducer back plate to define an air gap, the air gap communicating with the back volume through the plurality of cavities.

37. The electret sound transducer of claim 36, wherein:
the plurality of cavities comprises an array of about 25,000 holes extending through the back plate membrane layer.

38. The electret sound transducer of claim 37, wherein:
the membrane layer has a diameter of about 8 millimeters.

39. The electret sound transducer of claim 38, wherein:
the air gap is about 4.5 μm deep.

40. An electret sound transducer, comprising:

a transducer diaphragm including a membrane support structure and a membrane layer formed on the membrane support structure by micro-machining techniques, the transducer diaphragm having a first electrode;

a transducer back plate having a second electrode and formed by micro-machining techniques, the transducer back plate comprising a back plate support structure defining a back volume and a back plate membrane layer formed on the back plate support structure, the back plate membrane layer having a front face and a rear face, [the back plate membrane layer comprising a plurality of cavities extending from the front face to the rear face, thereby providing for communication between the front face and the back volume] and

an electret layer formed on at least one of the transducer diaphragm or the transducer back plate, the transducer diaphragm being positioned adjacent to the transducer back plate to form an electret sound transducer.

41. The electret sound transducer of claim 40, further comprising:

a polymeric reinforcing film formed on the back plate membrane layer, the plurality of cavities extending through the polymeric reinforcing film.

42. The electret sound transducer of claim 41, wherein:

the polymeric reinforcing film includes one of Mylar, FEP, a PTFE fluoropolymer, Teflon® AF, a silicone, or Parylene.

43. The electret sound transducer of claim 42, wherein:

the polymeric reinforcing film has a thickness in the range from about 0.1 μm to about 10 μm .

44. The electret sound transducer of claim 41, wherein:
the polymeric reinforcing film is spun or deposited onto the back plate membrane layer using micromachining techniques.

45. The electret sound transducer of claim 40, wherein:
the back plate support structure is formed from an electrically insulating or semiconducting glass, ceramic, crystalline, or polycrystalline material.

46. The electret sound transducer of claim 41, further comprising:
at least one spacer positioned between the transducer diaphragm and the transducer back plate to define an air gap, the air gap communicating with the back volume through the plurality of cavities.

47. The electret sound transducer of claim 46, wherein:
the plurality of cavities comprises an array of about 25,000 holes extending through the back plate membrane layer.

48. The transducer back plate of claim 47, wherein:
the membrane layer has a diameter of about 8 millimeters.

49. The electret sound transducer of claim 48, wherein:
the air gap is about 4.5 μm deep.

50. The electret sound transducer of claim 40, wherein:
the transducer has an open circuit sensitivity greater than about 25 mV/Pa.

51. The electret sound transducer of claim 50, wherein:
the transducer has a noise level of less than about 30 dB
SPL.

52. The electret sound transducer of claim 52, wherein:
the transducer has a total harmonic distortion of less
than about 2% at 110 dB SPL at 650 Hz.

~~53.~~ An electret sound transducer, comprising:
a transducer diaphragm including an IC-compatible
membrane support structure and a membrane layer formed on the
membrane support structure by micro-machining techniques, the
transducer diaphragm having a first electrode;
a transducer back plate having a second electrode and
formed by micro-machining techniques; and
an electret layer formed on at least one of the
transducer diaphragm or the transducer back plate, the
transducer diaphragm being positioned adjacent to the
transducer back plate to form an electret sound transducer
having an open-circuit sensitivity greater than about 25
mV/Pa, a noise level of less than about 30 dB SPL, and a total
harmonic distortion of less than about 2% at 110 dB SPL at 650
Hz.

54. The electret sound transducer of claim 53, wherein:
the transducer has an open circuit sensitivity of greater
than about 35 mV/Pa.

55. A method of fabricating a transducer diaphragm,
comprising:
providing an IC-compatible support structure;

005750-051900

OK Fr
2/6
Ref
55-74

forming a polymeric membrane layer on the support structure;

forming an electrode on the polymeric membrane layer; and
etching a portion of the support structure to form a transducer diaphragm.

56. The method of claim 55, wherein:

the polymeric membrane layer includes one of Mylar, FEP, a PTFE fluoropolymer, Teflon® AF, polyimide, a silicone, or Parylene.

57. The method of claim 55, wherein:

the polymeric membrane layer is spun on to a surface of the support structure.

58. The method of claim 55, wherein:

the polymeric membrane layer is deposited on a surface of the support structure.

59. The method of claim 55, wherein:

the polymeric membrane layer adheres to the support structure without requiring gluing.

60. The method of claim 55, wherein:

the polymeric membrane layer is formed at about room temperature.

61. The method of claim 55, wherein:

the polymeric membrane layer is formed to a thickness in the range from about 0.1 μm to about 10 μm .

62. The method of claim 55, wherein:

the polymeric reinforcing layer includes one of Mylar, FEP, a PTFE fluoropolymer, Teflon® AF, polyimide, a silicone, or Parylene.

67. The method of claim 65, wherein:

the polymeric reinforcing layer is formed at about room temperature.

68. The method of claim 65, wherein:

the polymeric reinforcing layer is formed to a thickness in the range from about .1 μm to about 10 μm .

69. The method of claim 65, wherein:

the support structure is formed from an electrically insulating or semiconducting glass, ceramic, crystalline, or polycrystalline material.

70. The method of claim 65, wherein:

the support layer is etched with bromine trifluoride.

71. The method of claim 65, further comprising:

forming at least one spacer on the polymeric reinforcing layer to define an air gap.

72. The method of claim 65, wherein:

the plurality of cavities comprises an array of about 25,000 holes extending through the insulating layer.

73. The method of claim 72, wherein:

the insulating layer has a diameter of about 8 millimeters.

THE UNIVERSITY OF CHICAGO